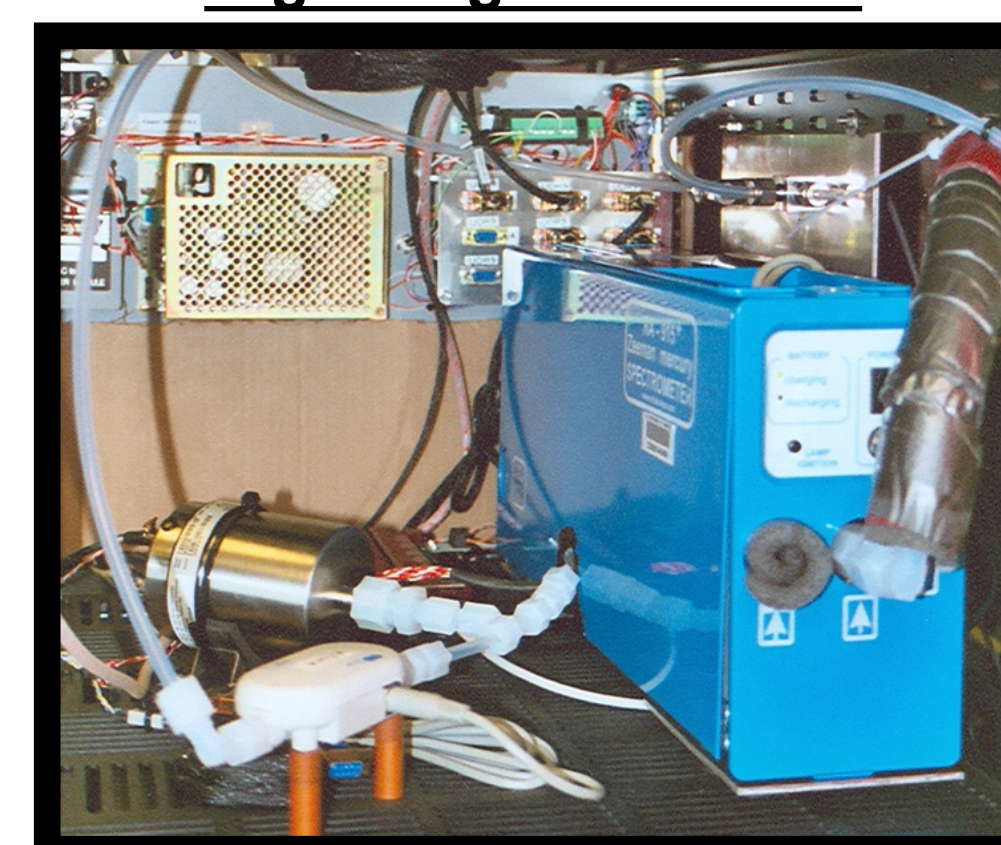


1. Introduction

More than 95% of atmospheric mercury (Hg) is present in its gaseous elemental state (Hg⁰). With a lifetime of 6 months to 2 years, this powerful neurotoxin can be transported far from source regions before it is ultimately oxidized to ionic Hg, deposited, methylated, and bioaccumulated in aquatic ecosystems. The subsequent human exposure to contaminated fish is a widespread health concern. Atmospheric Hg has both natural sources, such as oceans and volcanoes, and anthropogenic sources, such as coal combustion, waste incineration, and various manufacturing processes. Using measurements made aboard the NOAA research vessel (R/V) Ronald H. Brown during the 2006 TexAQSGoMACCS campaign we were able to survey coastal and inland waterways for potential sources.

2. Instrument Details

Fig. 1: Hg Instrument



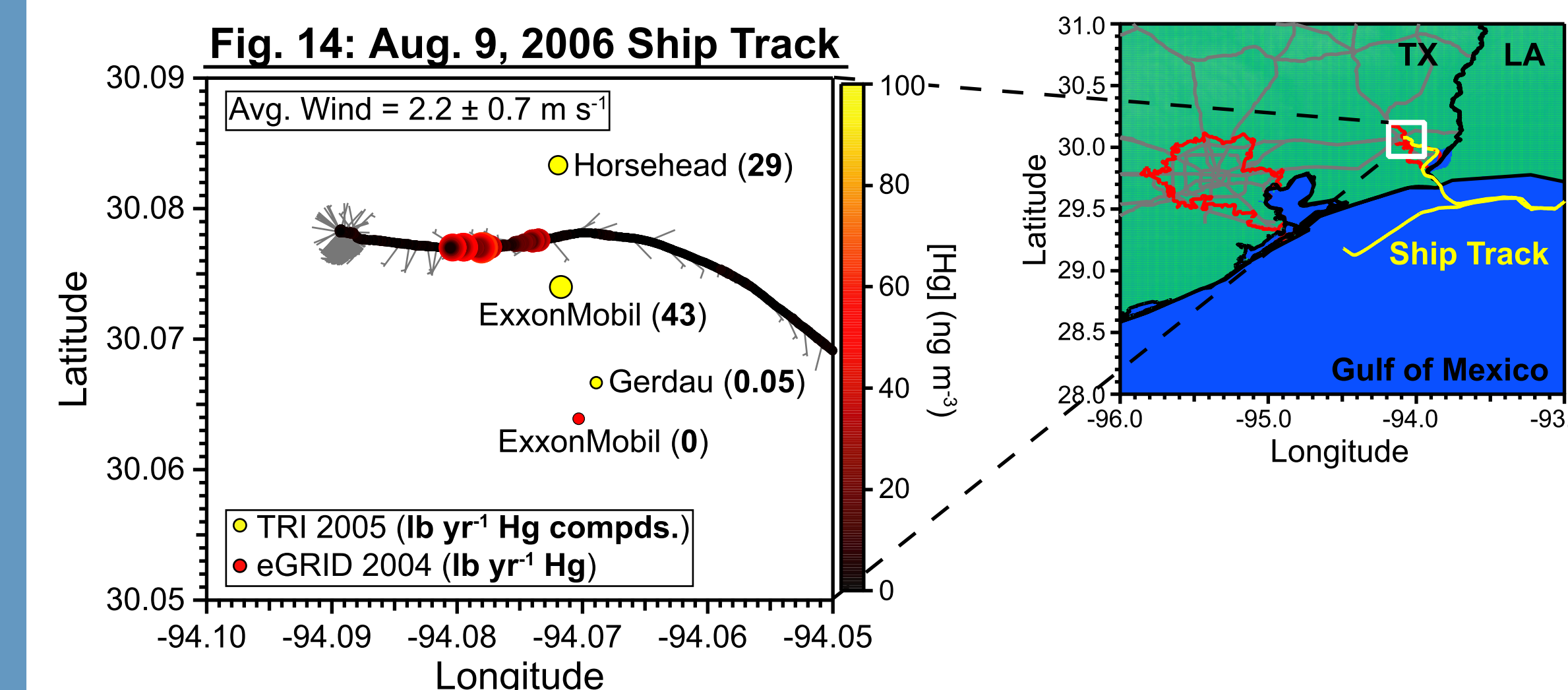
- Modified Lumex RA-915+ Hg analyzer
- Selectively detects Hg⁰ using CVAAS¹ with Zeeman high-frequency polarization modulation
- No preconcentration or desorption steps
- Data reported at 1 Hz, uncertainty of $\pm (16\% + (1.5 - 3.8) \text{ ng m}^{-3})$

3. Additional Measurements*

Species	Technique
NO	Chemiluminescence
NO ₂	Chemiluminescence
SO ₂	UV Pulsed Fluorescence
CO	UV Res. Fluorescence
NH ₃	QCL
C ₂ H ₄	QCL
CH ₃ OH	PIT-MS

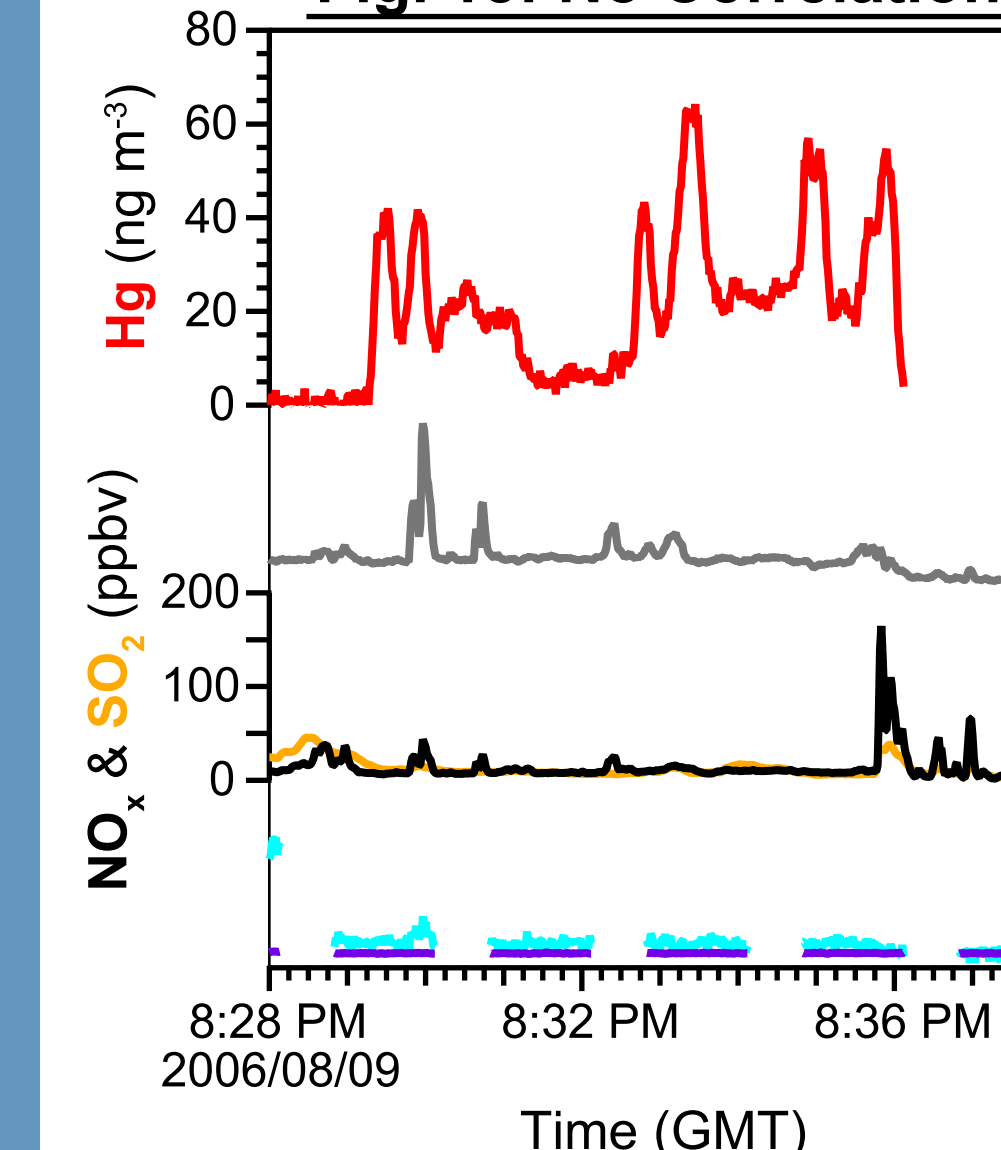
*See appropriate posters for additional details.

5. Beaumont Observations



- Winds are light and variable. Cannot rule out any known Hg point sources based on winds alone (Fig. 14).

Fig. 15: No Correlation



- No correlation with any measured chemical species (Fig. 15).
- Chemistry rules out any Hg sources reported in available emissions inventories.
- Future work will look into additional potential area sources.

6. Summary

- If it is accurate to assume co-emission of all reported chemical species, the observed Hg plumes are not commensurate with available Hg point source emissions inventories.
- Continuing analysis will investigate ongoing remediation efforts as a potential source of the large, persistent Hg plume observed in the Houston Ship Channel (HSC).
- Additional potential sources for the smaller HSC plume and the large Beaumont plume are yet to be identified.

Notes

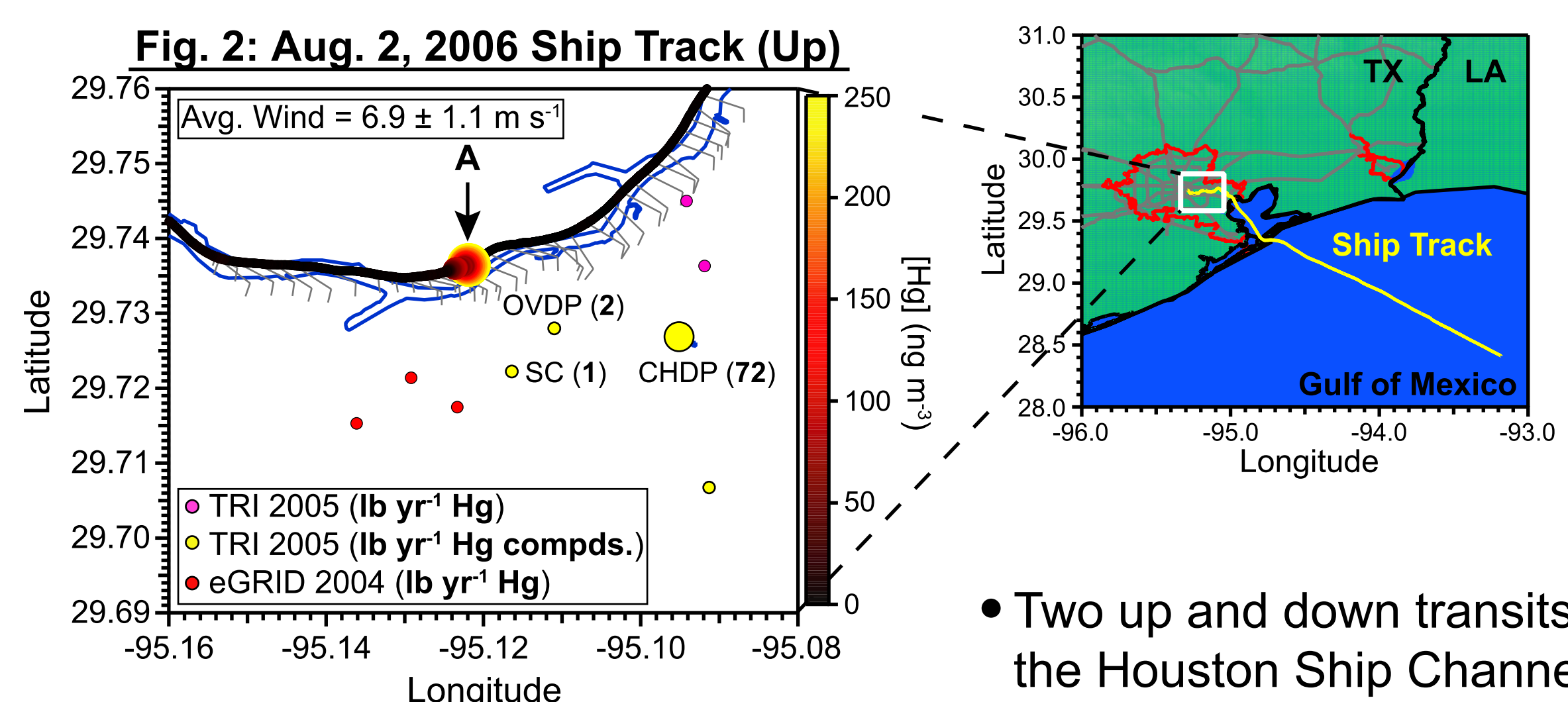
- ¹CVAAS = Cold Vapor Atomic Absorption Spectroscopy
- ²Satellite images obtained from Google Earth v. 4.1.7076.4458 (beta)
- ³OxyVinyls PVC SIC = 2821 = Plastics Materials, Synthetic Resins, & Nonvulcanizable Elastomers

The authors thank Rebecca Rentz at TCEQ for bringing to our attention the OxyVinyls VCP site and providing us with preliminary information.

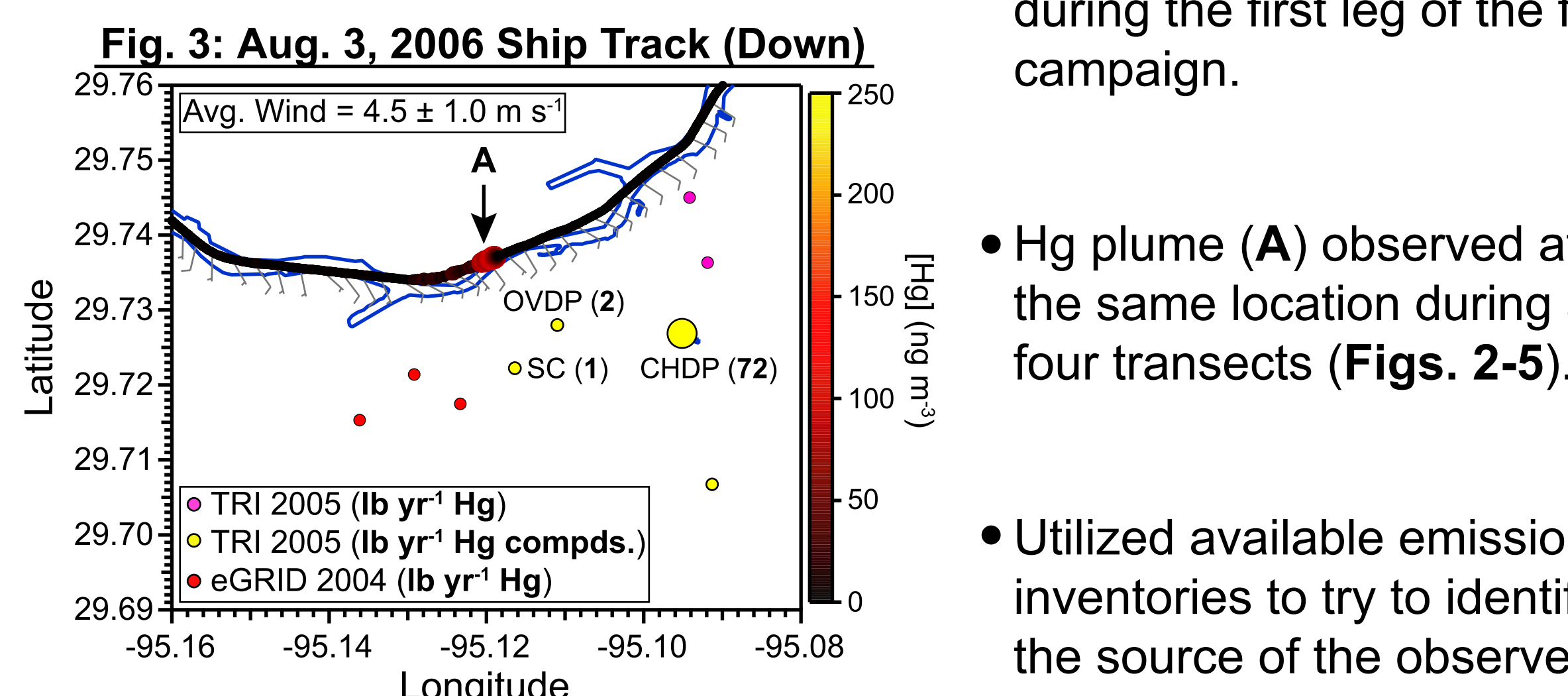
*Corresponding Author: Tara.Fortin@noaa.gov, 303-497-4468

4. Houston Ship Channel Observations

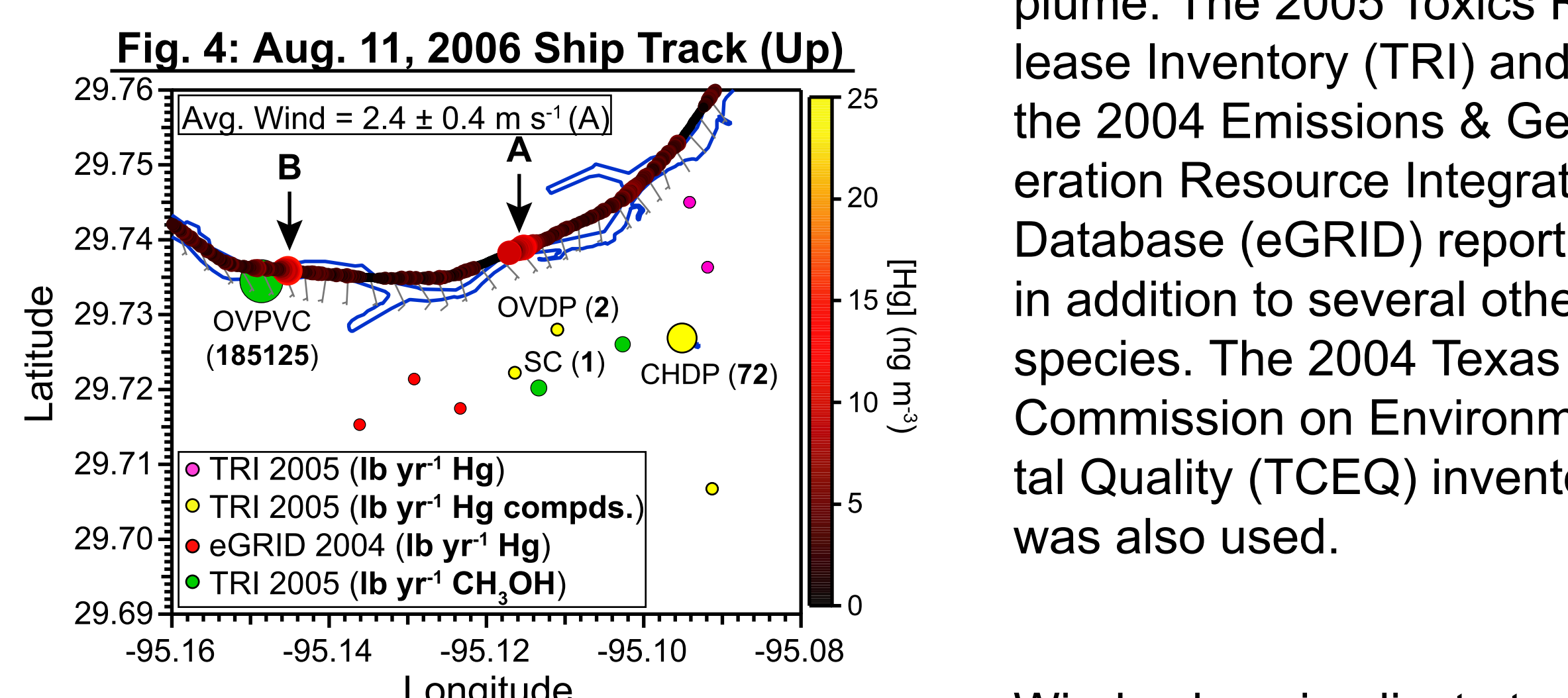
4a



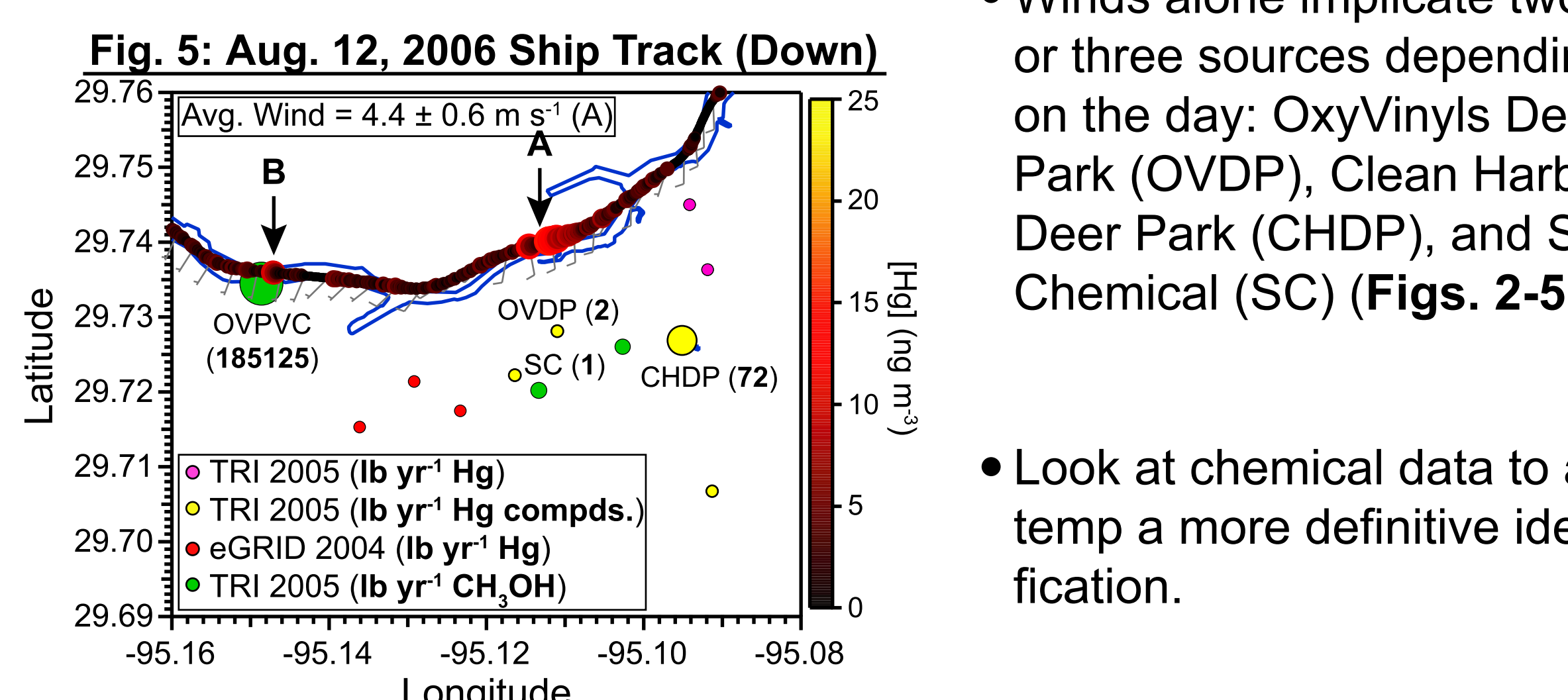
- Two up and down transits of the Houston Ship Channel during the first leg of the field campaign.



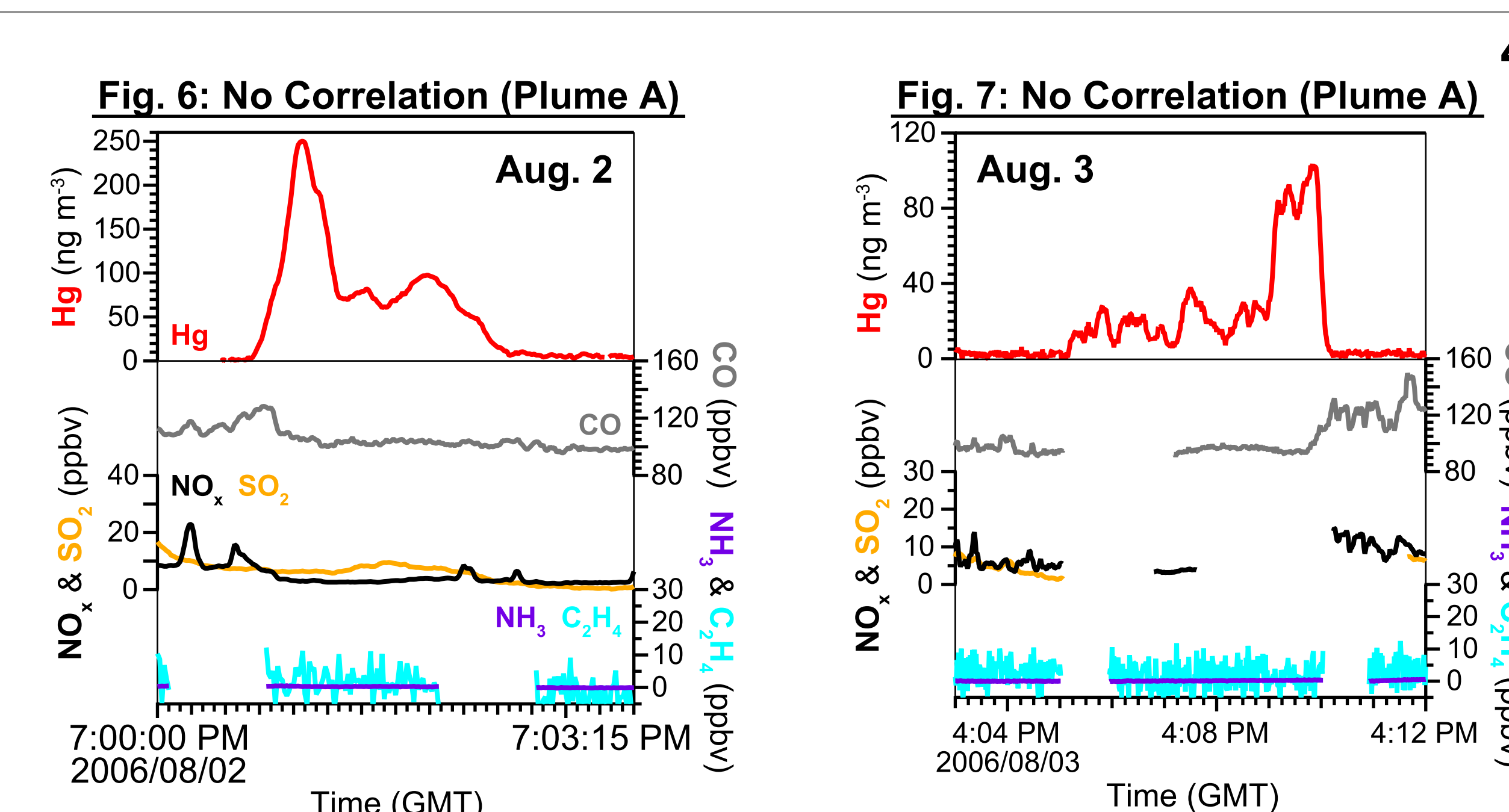
- Hg plume (A) observed at the same location during all four transects (Figs. 2-5).



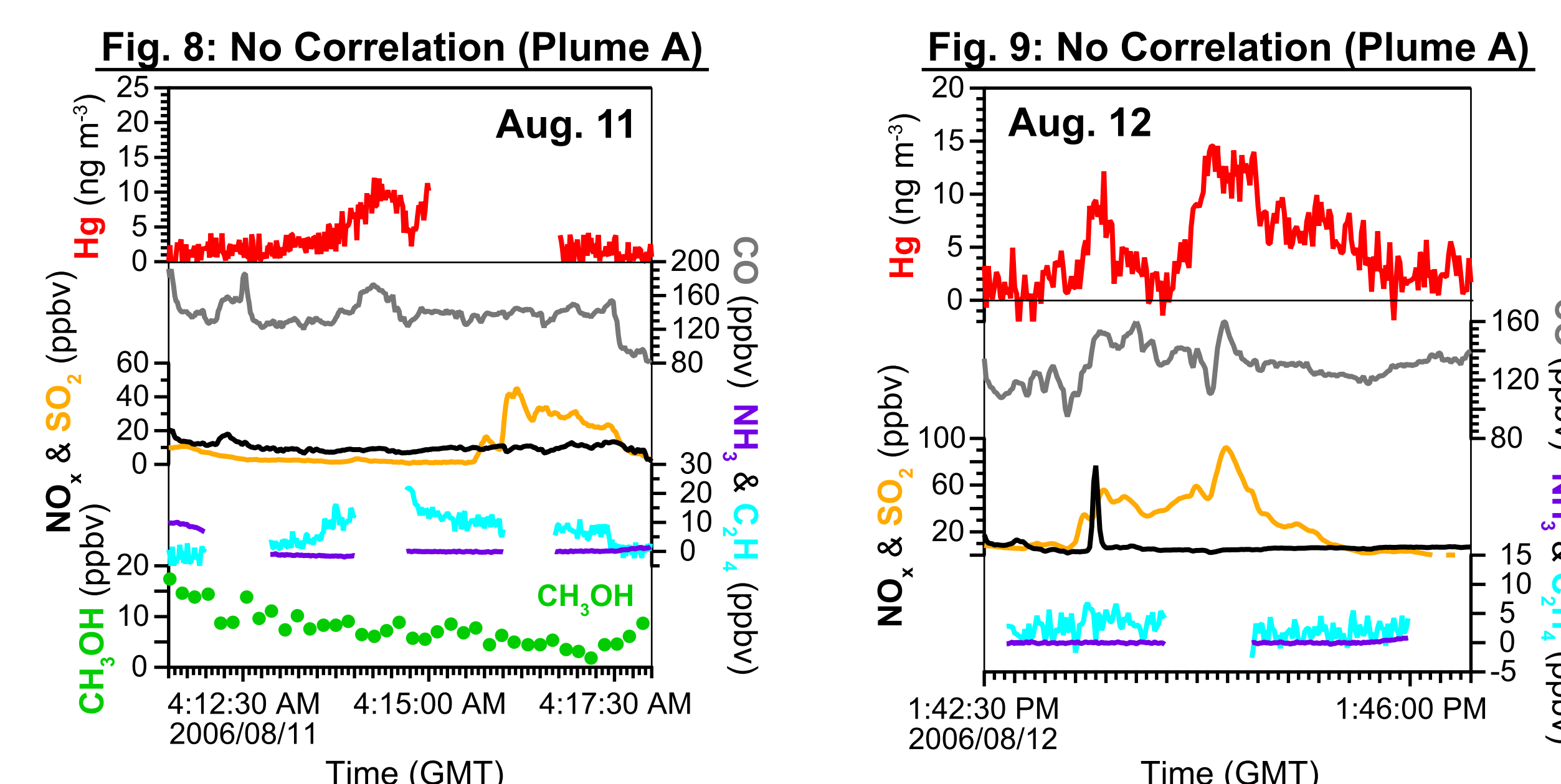
- Utilized available emissions inventories to try to identify the source of the observed plume. The 2005 Toxics Release Inventory (TRI) and the 2004 Emissions & Generation Resource Integrated Database (eGRID) report Hg in addition to several other species. The 2004 Texas Commission on Environmental Quality (TCEQ) inventory was also used.



- Winds alone implicate two or three sources depending on the day: OxyVinyls Deer Park (OVPD), Clean Harbors Deer Park (CHDP), and Shell Chemical (SC) (Figs. 2-5).
- Look at chemical data to attempt a more definitive identification.

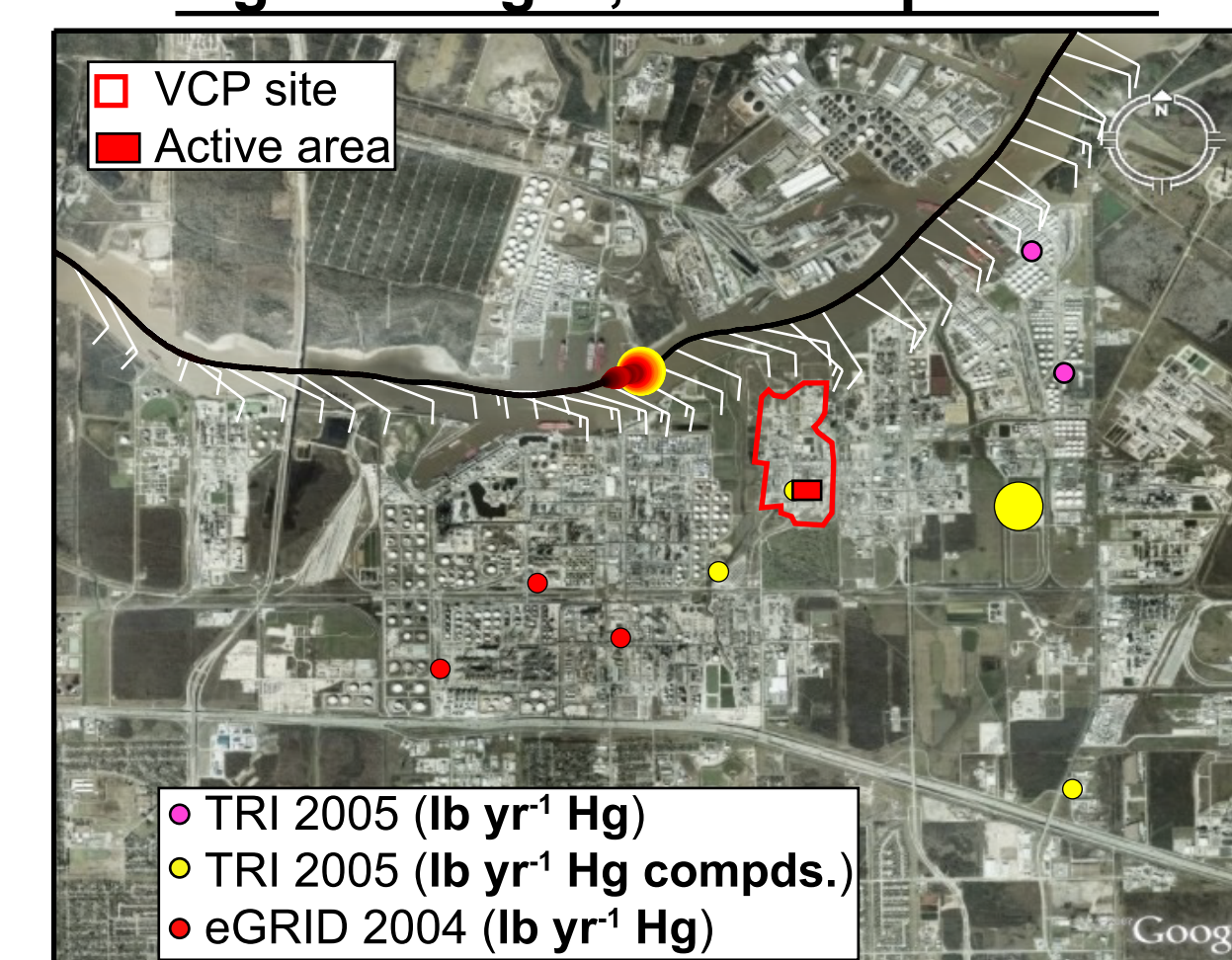


4b



- Assuming at least some reported species would be co-emitted with Hg, we look for correlation with combustion tracers (NO_x, SO₂, CO, etc.) and various toxics (NH₃, C₂H₄, CH₃OH, etc.) as a means of identifying inventoried point sources in the area.
- There is no significant correlation with any species on all four days (Fig. 6-9). Therefore, the observed chemistry rules out point sources identified in available inventories as the source of the observed Hg plume (A).

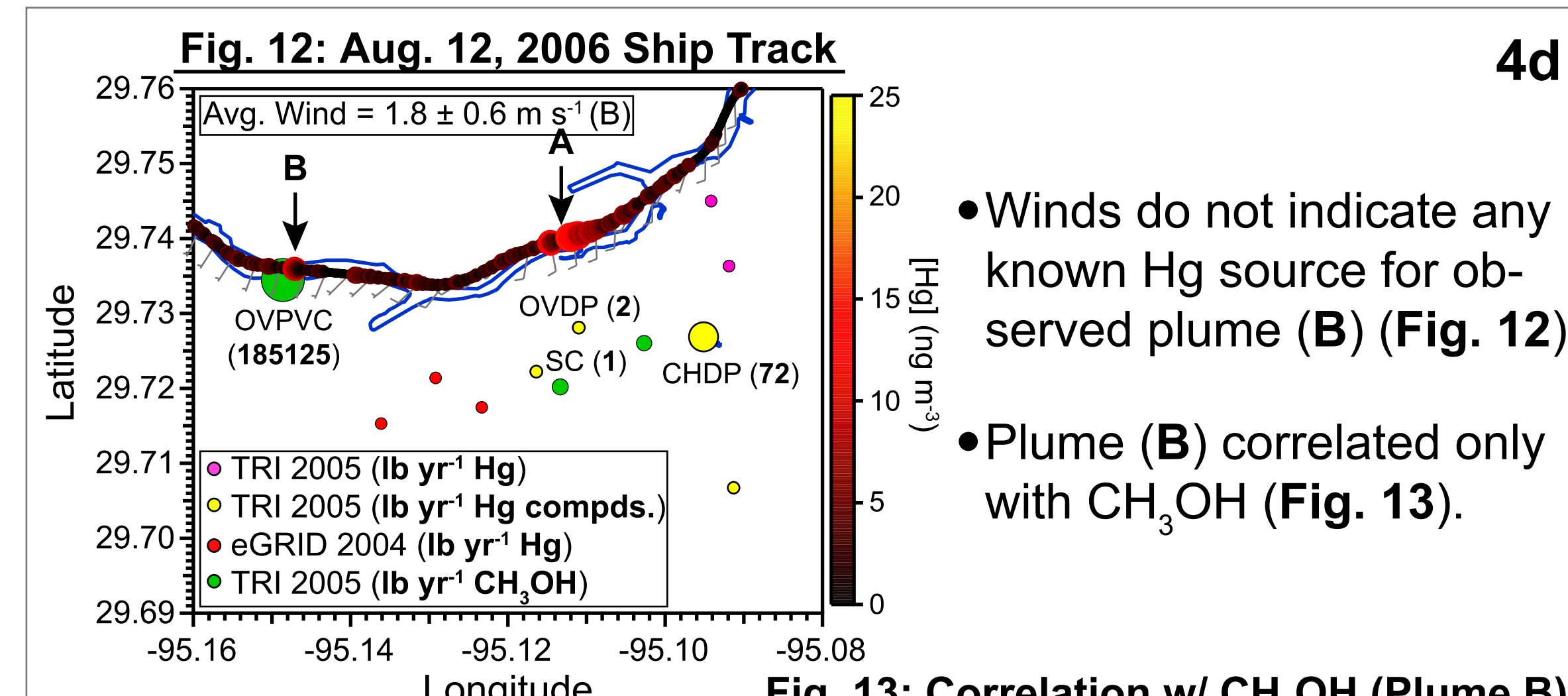
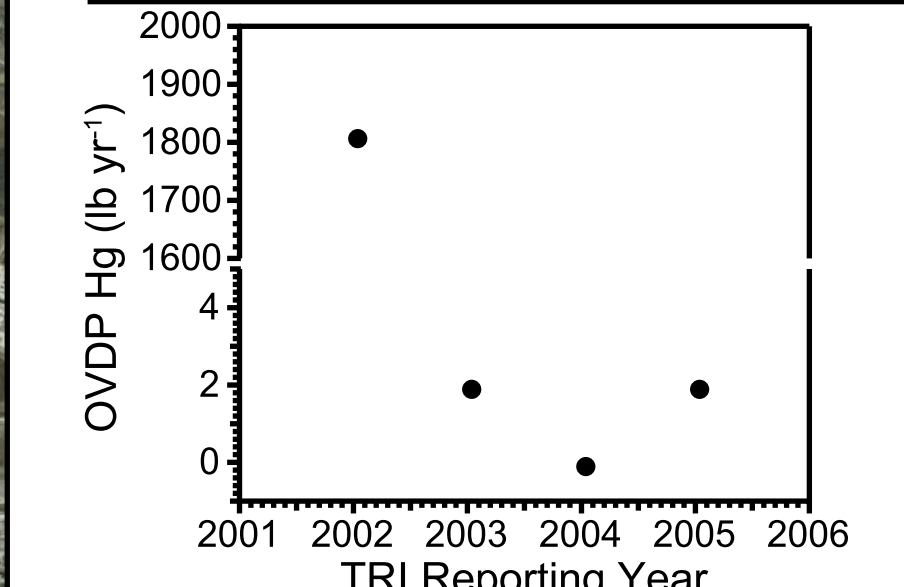
Fig. 10: Aug. 2, 2006 Ship Track²



- OxyVinyls Deer Park (OVPD) is participating in TCEQ's Voluntary Cleanup Program (VCP) (Fig. 10). The site has a reported history of significant Hg emissions (Fig. 11) and is known to have Hg-contaminated soils. Remediation efforts were ongoing in August of 2006 ('Active area' in Fig. 10).

- The area is consistent with both winds and the observed chemistry on all four days (Figs. 2-9).
- Additional work is needed to rule the area in or out as the source of the observed Hg plumes (A).

Fig. 11: Emissions History



- Winds do not indicate any known Hg source for observed plume (B) (Fig. 12).
- Plume (B) correlated only with CH₃OH (Fig. 13).

- Winds indicate CH₃OH is from OxyVinyls PVC (OVPVC) (Fig. 12) but OVPVC does not appear as a Hg point source in available inventories.
- Based on OVPVC's Standard Industrial Classification (SIC)³ it is unlikely that OVPVC is emitting unreported Hg.
- Additional work is needed to identify the source of plume B.